U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

REVIEW RESPONSIBILITIES

Primary - ~~Siting Analysis Branch (SAB)~~Civil Engineering and Geosciences Branch (ECGB)[1]

Secondary - None

I. AREAS OF REVIEW

The applicant's identification of potential accident situations on site and in the vicinity of the plant with the potential to affect safety-related features[2] is reviewed to determine the completeness of and the bases upon which these potential accidents were or were not accommodated in the design. (See Standard Review Plan (SRP) Sections~~ 2.2.1 and 2.2.2.)~~2.2.1 - 2.2.2.[3])

The analyses of the consequences of accidents on site and[4] those involving nearby industrial, military, and transportation facilities which have been identified as design basis events are reviewed.

Review Interfaces

The ECGB will coordinate other branch evaluations with the overall review of potential accidents, as follows:[5]

1.[6] With respect to potential offsite accidents which could affect control room habitability (e.g., toxic gases, asphyxiants), those accidents which are to be accommodated on a design basis, as determined within SRP Section 2.2.3 review, will be addressed by the ~~Accident Evaluation Branch (AEB)~~Plant Systems Branch (SPLB)[7] as part of its primary

review responsibility for~~within~~ SRP Section 6.4. ~~review~~[8]~~, in accordance with TMI-Related Requirement III.D.3.4 of NUREG-0694.~~[9]

2. The applicant's probability analyses of potential accidents involving hazardous materials or activities on site and[10] in the vicinity of the plant, if such analyses have been performed, are also reviewed by the ~~Applied Statistics Branch (ASB/MPA)~~Division of Budget and Analysis, Office of the Controller,[11] on request by ~~SAB~~ECGB[12] to determine that appropriate data and analytical models have been utilized.

For areas of review identified as part of the primary responsibility of other branches, acceptance criteria and methodologies for these reviews are contained in the referenced SRP section of the corresponding primary review branch.[13]

II. ACCEPTANCE CRITERIA

~~SAB~~ECGB[14] acceptance criteria are based on meeting the relevant requirements of 10 CFR ~~Part 100, §~~[15] 100.10, ~~(Ref. 1)~~[16] as it relates to the factors to be considered in the evaluation of sites, which indicates that reactors should reflect through their design, construction, and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products. In addition, 10 CFR ~~Part 100, §~~100.10~~,~~ indicates that the site location, in conjunction with other considerations, should ~~insure~~ ensure[17] a low risk of public exposure.

Specific criteria necessary to meet the relevant requirements of 10 CFR ~~Part 100, §~~100.10 are described in the following paragraphs:

Offsite and onsite[18] hazards which have the potential for causing onsite accidents leading to the release of significant quantities of radioactive fission products, and thus pose an undue risk of public exposure, should have a sufficiently low probability of occurrence and be within the scope of the low probability of occurrence criterion of 10 CFR ~~Part 100, §~~100.10. Specific guidance with respect to ~~offsite~~such[19] hazards is provided in Chapter 2, Section 2.2.3, of Regulatory Guide (RG) 1.70[20] ~~(Ref. 2)~~.[21] As indicated therein, the identification of design basis events resulting from the presence of hazardous materials or activities on site and[22] in the vicinity of the plant is acceptable if the design basis events include each postulated type of accident for which the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines is estimated to exceed the NRC staff objective of approximately 10^{-7} per year. Because of the difficulty of assigning accurate numerical values to the expected rate of unprecedented potential hazards generally considered in this SRP section, judgment must be used as to the acceptability of the overall risk presented.

The probability of occurrence of the initiating events leading to potential consequences in excess of 10 CFR Part 100 exposure guidelines should be estimated using assumptions that are as representative of the specific site as is practicable. In addition, because of the low probabilities of the events under consideration, data are often not available to permit accurate calculation of probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of approximately 10^{-6} per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower.

The effects of design basis events have been adequately considered if analyses of the effects of those accidents on the safety-related features of the plant have been performed and measures have been taken (e.g., hardening, fire protection) to mitigate the consequences of such events.

Technical Rationale

The technical rationale for application of acceptance criteria for the evaluation of potential accidents is discussed in the following paragraphs:[23]

Compliance with 10 CFR 100.10 requires that evaluation of reactor sites include factors related to proposed reactor designs as well as to characteristics peculiar to individual sites. Through its design, construction, and operation, a reactor should reflect an extremely low probability for accidents that could result in release of significant quantities of radioactive fission products. In addition, the site's location and engineered features included as safeguards against the hazardous consequences of an accident should ensure a low risk of public exposure. When determining the acceptability of a site for a reactor, the use characteristics of the site environs (including those in the exclusion area and the low population zone) should be considered.

Onsite or nearby facilities that could pose a risk to safe reactor operation include (1) onsite storage of liquid hydrogen or propane and (2) industrial, transportation, or military facilities that could involve the use of hazardous materials (e.g., oil or toxic chemicals) or pose other risks (e.g., a barge collision with the intake structure or an airplane crash at the site). On the basis of the information provided in SRP Section 2.2.1 - 2.2.2, the potential accidents regarded as design basis events are determined and reviewed under SRP Section 2.2.3. The design basis events on site or in the vicinity of the nuclear plant are defined as accidents with a probability of occurrence of about 10^{-7} per year or greater and with potential consequences serious enough to affect the safety of the plant to the extent that 10 CFR Part 100 guidelines could be exceeded. Where unfavorable physical characteristics exist, the proposed site may be found acceptable if the facility design includes appropriate and adequate engineering safeguards to compensate for observed deficiencies. RG 1.91 provides guidance for evaluating postulated explosions on transportation routes near nuclear plants.

Meeting these requirements provides a level of assurance that the plant is adequately protected and can be operated with an acceptable degree of safety in the event of an accident caused by the presence of hazardous materials or activities on site and/or at nearby industrial, military, or transportation facilities.[24]

III. REVIEW PROCEDURES

In some cases it may be necessary to consult with or obtain specific data from other branches, such as the ~~Structural Engineering Branch (SEB)~~[25] ~~or Auxiliary Systems Branch (ASB)~~Plant Systems Branch (SPLB),[26] regarding possible effects of external events on plant structures or components.

The applicant's probability calculations are reviewed, and an independent probability analysis is performed by the staff if the potential hazard is considered significant enough to affect the licensability of the site or is important to the identification of design basis events.

All stochastic variables that affect the occurrence or severity of the postulated event are identified and judged to be either independent or conditioned by other variables.

Probabilistic models should be tested, where possible, against all available information. If the model or any portion of it, by simple extension, can be used to predict an observable accident rate, this test should be performed.

The design parameters (e.g., overpressure) and physical phenomena (e.g., gas concentration) selected by the applicant for each design basis event are reviewed to ascertain that the values are comparable to the values used in previous analyses and found to be acceptable by the staff.

Acceptable safety analyses for the onsite storage and use of compressed or liquid hydrogen, liquid oxygen, and propane are provided in References 6 and 7.[27] Other examples of acceptable risk assessments are listed in the references subsection of this SRP section and in SRP Section 2.2.1 - 2.2.2.[28]

Each design basis event is reviewed to determine that the effects of the event on the safety features of the plant have been adequately accommodated in the design.

If accidents involving release of smoke, flammable or nonflammable gases, or toxic chemical-bearing clouds are considered to be design basis events, an evaluation of the effects of these accidents on control room habitability should be made in ~~SAR~~ Safety Analysis Report (SAR)[29] Section 6.4 and on the operation of diesels and other safety-related equipment in SAR Chapter 9.

Special attention should be given to the review of standardized designs which propose criteria involving individual numerical probability criteria for individual classes of external manmade hazards. In such instances the reviewer should establish that the envelope also includes an overall criterion that limits the aggregate probability of exceeding design criteria associated with all of the identified external manmade hazards. Similarly, special attention should be given to the review of a site where several manmade hazards are identified, but none of which, individually, has a probability exceeding the acceptance criteria stated herein. The objective of this special review should be to ~~assure~~ ensure[30] that the aggregate probability of an outcome that may lead to unacceptable plant damage meets the acceptance criteria of subsection II of this SRP section. (A hypothetical example is a situation where the probability of shock wave overpressure greater than design overpressure is about 10^{-7} per reactor year from accidents at a nearby industrial facility, and approximately equal probabilities of exceeding design pressure from railway accidents, highway accidents, and ~~from~~[31] shipping accidents. Individually each may be judged acceptably low; the aggregate probability may be judged sufficiently great that additional design features are warranted.)

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[32]

IV. EVALUATION FINDINGS

If the reviewer, after a review of the onsite and[33] offsite hazards identified in SRP Section 2.2.1 - 2.2.2 and evaluated in the above SRP section, concludes that the probability of exceeding the 10 CFR Part 100 dose guidelines due to onsite and[34] offsite hazards is within the acceptance criteria given in subsection II of this SRP section, then the staff concludes that the site location ~~insures~~ ensures a low risk of exposure, in compliance with 10 CFR ~~Part 100, §~~100.10. A conclusion of the following type may be prepared for the staff's safety evaluation report (SER).[35]

> The staff concludes that the site location is acceptable and meets the relevant requirements of 10 CFR Part 100. This conclusion is based on the following. The applicant has identified potential accidents related to the presence of hazardous materials or activities on site and[36] in the site vicinity which could affect the plant, and from these the applicant has selected those which should be considered as design basis events and has provided analyses of the effects of these accidents on the safety-related features of the plant. From the analyses, the applicant has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to potential accidents which may occur as the result of the presence of hazardous materials or activities on site and[37] at nearby industrial, military, and transportation facilities.

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[38]

V. IMPLEMENTATION

The following provides guidance to applicants and licensees regarding the NRC staff's plan for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[39] Except in those cases in which the applicant proposes an acceptable alternate method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[40]

VI. REFERENCES

1. 10 CFR Part 100, "Reactor Site Criteria," Section 100.10.

2. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."

3. Affidavit of Jacques B. J. Read before the Atomic Safety and Licensing Board in the matter of Skagit Nuclear Power Project, Units 1 and 2, July 15, 1976. Docket Nos. STN 50-522, 523.

4. Atomic Safety and Licensing Board, Supplemental Initial Decision in the Matter of Hope Creek Generating Station, Units 1 and 2, March 28, 1977. Docket Nos. 50-354, 355.

5. Section 2, Supplement 2 to the Floating Nuclear Plant Safety Evaluation Report, Docket No. STN 50-437, September 1976.

6. NRC Staff Safety Evaluation Report (July 1987) contained in Electric Power Research Institute (EPRI) Report NP-5283-SR-A, "Guidelines for Permanent BWR Hydrogen Water Chemistry Installation - 1987 Revision."[41]

7. Safety Evaluation Relating to the Operation of a Mobile Volume Reduction System, August 13, 1986, Commonwealth Edison Company, Dresden Station, Unit Nos. 2 and 3, Docket Nos. 50-237 and 50-249.[42]

SRP Draft Section 2.2.3
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current primary review branch and designation	Changed PRB to ECGB.
2.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered. Added the phrase "with the potential to affect safety-related features" to clarify the scope of the review.
3.	Editorial correction	Provided initialism "SRP" for "Standard Review Plan." In addition, SRP Sections 2.2.1 and 2.2.2 have been combined into one section, designated as SRP Section 2.2.1 - 2.2.2.
4.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
5.	SRP-UDP format item	Added "Review Interfaces" and lead-in paragraph under AREAS OF REVIEW.
6.	SRP-UDP format item	Labeled review interface information as paragraphs 1 and 2.
7.	Current review branch name and designation	Changed review interface to SPLB.
8.	Editorial modification	Changed the text to indicate that SPLB has primary review responsibility for SRP Section 6.4.
9.	Editorial deletion	Deleted reference to TMI Action Plan item III.D.3.4, "Control Room Habitability," since this aspect of the review is included in SRP Section 6.4. The reference to NUREG-0694 is out-of-date. Review of III.D.3.4 is but one aspect of the review under SRP Section 6.4.
10.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
11.	Current review branch name	Changed review interface to Division of Budget and Analysis, Office of the Controller.
12.	Current primary review branch designation	Changed PRB to ECGB.
13.	SRP-UDP format item	Added standard language to follow the designation of review interfaces.
14.	Current primary review branch designation	Changed PRB to ECGB.
15.	Editorial correction	Provided correct format for citing references to Title 10 of the Code of Federal Regulations (global for this section.)

Item	Source	Description
16.	SRP-UDP format item	Deleted unnecessary citation for Reference 1.
17.	Editorial correction	Corrected spelling of "insure" to "ensure" (global for this section)
18.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
19.	Editorial correction	Replaced "offsite" with "such" because Section 2.2.3 of Regulatory Guide 1.70 discusses onsite hazards (e.g., chlorine release from an onsite storage facility) as well as offsite hazards.
20.	SRP-UDP format item	Regulatory Guide 1.70 should be updated, as noted in Form IPD 7.0 No. 2.2.3-1.
21.	SRP-UDP format item	Deleted unnecessary citation for Reference 2.
22.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
23.	SRP-UDP format item	Added "Technical Rationale" and lead-in paragraph to ACCEPTANCE CRITERIA.
24.	SRP-UDP format item	Added technical rationale related to 10 CFR 100.10.
25.	Editorial modification	Review responsibilities previously assigned to the Structural Engineering Branch are now assigned to ECGB.
26.	Current review branch name and designation	Changed review interface to SPLB.
27.	Integrated Impact 1347	Indicated that acceptable safety analyses for the onsite storage of bulk compressed or liquid hydrogen, liquid oxygen, and propane are contained in References 6 and 7.
28.	Editorial modification	Indicated that REFERENCES in SRP Sections 2.2.3 and 2.2.1 - 2.2.2 contain examples of acceptable risk assessments.
29.	Editorial modification	Defined "SAR" as "Safety Analysis Report."
30.	Editorial correction	Corrected spelling of "assure" to "ensure."
31.	Editorial correction	Deleted "from" to maintain parallel structure.
32.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
33.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
34.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.

Item	Source	Description
35.	Editorial modification	Added initialism for "safety evaluation report."
36.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
37.	Integrated Impact 1347	Indicated that potential accidents on site, as well as those in the vicinity of the site, should be considered.
38.	SRP-UDP format item	Added paragraph to EVALUATION FINDINGS describing design certification reviews (10 CFR Part 52).
39.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
40.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
41.	Integrated Impact 1347	Added the NRC staff Safety Evaluation of EPRI NP-5283-SR-A to REFERENCES.
42.	Integrated Impact 1347	Added the NRC staff Safety Evaluation of the Dresden Mobile Volume Reduction System to REFERENCES.

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SRP Draft Section 2.2.3

Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
1347	Revise SRP Section 2.2.3 to include consideration of onsite hazards, such as an accident at an onsite bulk storage facility for liquid hydrogen, liquid oxygen, or propane.	I (2 places); I.2; II (2 places); III; IV (4 places); VI.6 & 7.